

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
B.Tech Degree S6 (R,S) Examinations April 2026 (2019 Scheme)



Course Code: AIT304

Course Name: ROBOTICS AND INTELLIGENT SYSTEM

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks.

Marks

- | | | |
|----|--|-----|
| 1 | Compare active and passive grippers used in robotic systems. | (3) |
| 2 | State the three laws of a robot. | (3) |
| 3 | Explain Dynamic range, Linearity and Resolution of a Sensor. | (3) |
| 4 | Define the term sensor, and differentiate the same from the transducer. | (3) |
| 5 | List any three differences between car-like and differential-drive robots. | (3) |
| 6 | What are the common wheel types used in mobile robots? | (3) |
| 7 | Identify the 2 mobile robot localization problems. | (3) |
| 8 | State the applications and advantages of SLAM robots. | (3) |
| 9 | List any three advantages of using A* algorithm in robotic navigation. | (3) |
| 10 | What is the role of neural networks in autonomous robot navigation? | (3) |

PART B

Answer one question from each module, each carries 14 marks.

Module I

- | | | |
|----|--|-----|
| 11 | a) Describe the four fundamental robot configurations based on different coordinate systems. | (8) |
| | b) Describe mechanical, magnetic, and vacuum grippers used in robotics. | (6) |

OR

- | | | |
|----|---|-----|
| 12 | a) Explain the general features of wheeled, legged and aerial robots. | (9) |
| | b) What are the major applications of robots | (5) |

Module II

- 13 a) A mobile robot is designed for unidirectional motion with constant velocity. (8)
Design a mechanism to make the robot move in forward and reverse directions with controllable speed and suggest the sensors and motion control drives required to achieve the same.

- b) Compare hydraulic and pneumatic actuators used in robotic systems. (6)

OR

- 14 a) Explain with a neat circuit diagram the working principle behind a permanent magnet stepper motor. (6)

- b) Briefly describe the speed and direction control of DC motor using H Bridge and PWM. (8)

Module III

- 15 a) Outline the seven stages of robot vision. (8)

- b) A frame F has been moved 10 units along the y-axis and 5 units along the z-axis of the reference frame. Find the new location of the frame. (6)

$$F = \begin{bmatrix} 0.527 & -0.574 & 0.628 & 5 \\ 0.369 & 0.819 & 0.439 & 3 \\ -0.766 & 0 & 0.643 & 8 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

OR

- 16 a) Explain the relationship between mobility, steerability, and manoeuvrability in mobile robot design. (6)

- b) Describe the structure and movement of a car-like wheeled mobile robot. (8)

Module IV

- 17 a) Explain the challenges of localization (6)

- b) How can probabilistic map-based localization be performed in mobile robots, and which filtering method is best suited for it? (8)

OR

- 18 a) Derive error model for odometric position estimation. (8)

- b) Compare graph-based SLAM and particle filter SLAM. (6)

Module V

- 19 a) Describe the Bug algorithm for obstacle avoidance in mobile robots. (7)

- b) Describe the Dynamic Window Approach (DWA) used for real-time obstacle avoidance. (7)

OR

- 20 a) Explain BFS(Breadth First Search) algorithm with example. (7)
- b) Explain the working of the Vector Field Histogram (VFH) method for obstacle avoidance. (7)
